CHAPTER IX

Impulse-reaction Type Turbines

The impulse-reaction type of turbine, with the adoption of the single-impulse stage compounded for velocity in place of a series of reaction stages at the high-pressure end of the turbine, results in a substantial shortening of the turbine, so that it has been found possible to build such machines in a single casing for large outputs at high speeds, with the critical speed 50 per cent above the normal speed.

It is further claimed that the lower blade efficiency in the impulse stage is compensated for by the reduced leakage losses, so that the over-all efficiency of the stage is no less than that of the series of reaction stages which it replaces.

The adoption of the initial impulse stage confines the steam at high pressure and temperature to the throttle valves and nozzle box and plate, so that for normal steam conditions these parts are the only parts that require to be made of cast steel.

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Fig. 36 shows a section through a 20,ooo-Kw. impulse-reaction turbine built by Messrs. Richardsons, Westgarth, & Co., Ltd., of Hartlepool. In a turbine of this description there is, of course, under certain conditions of working, a considerable end thrust, but this is compensated for by means of a single dummy piston at the high-pressure end so arranged that the steam passing the dummy is expanded to the pressure prevailing at the inlet of the low-pressure section of the turbine, so that the loss in heat drop of the balancing steam is only that due to the drop over the intermediate-pressure section.

A single dummy does not fully balance the whole of the end thrust under every condition, and a thrust block of the Michell type is fitted to take up any unbalanced end thrust and for the purpose of adjusting the align-ment.

In the larger units of 10,000 Kw. and above, two steam inlet valves are fitted which enable smaller valves to be used, and to ensure more equal temperature distribution over the high-pressure end of the cylinder.

A considerable amount of attention has been given to the design of a

stream-line type of exhaust bend to minimize the losses between the last row of blades in the condenser inlet.

In order to reduce the depth of the condenser pits in large units, the bedplate supporting the exhaust end of the turbine has been designed to form two girders sufficiently deep to carry the weight of the turbine and the condenser, and to take the place of girders between the two supporting concrete blocks.

The shafts of smaller machines are of simple drum construction with shaft ends at either end, the disc carrying the impulse blading being bolted to the high-pressure end of the drum. In the present design it will be seen that the rotor is of built-up construction, a shaft of comparatively small